

Study on Strength Properties of Concrete Containing Coconut Shell as Coarse Aggregate

Brindhalakshmi M.L.# and Gunasekar S#

#U.G Student, Department of Civil Engineering, K.S.Rangasamy College of Technology, Tiruchengode, Namakkal – 637215, Tamilnadu. India.
Assistant Professor, Department of Civil Engineering, K.S.Rangasamy College of Technology, Tiruchengode, Namakkal – 637215, Tamilnadu. India.

Received 05 Aug 2021, Accepted 10 Aug 2021, Available online 15 Aug 2021, **Special Issue-9 (Aug 2021)**

Abstract

Coconut shells are a type of agricultural waste which can be converted into useful material. A large amount of waste coconut shell is generated in Indian temples and industry of coconut product and its disposal need to be addressed. This experimental work will discuss about the effects of replacing coconut shell as coarse aggregate in concrete with 0%, 10%, 20% and 30% to produce Eco friendly concrete. Various properties like compressive strength, split tensile strength, water absorption and flexural test will be investigated with reference of Control concrete by adding normal coarse aggregate as well as coconut shell in concrete mixes. The age for testing were 7, 14 and 21 days respectively. Results revealed that with 20% replacement of conventional coarse aggregate as coconut shell. The results confirm that although there is utilization of waste coconut shell, reduction in natural source depletion etc., the use of coconut shell in concrete seems to be a feasible option.

Keywords: Concrete, Coconut shell, Aggregate Replacement, Waste Management, Strength Study.

1. Introduction

The most critical issue in environment protection and natural resource conservation is waste management. Changes in environment and an increase in population are the main causes of the many processes of deterioration which have altered the ecosystem of our planet, including the generation of municipal solid waste. Therefore, there is a need to reuse waste to create a greener and healthier place on earth. The usage of agricultural waste will be emphasized in this research. Being renewable, low-cost, lightweight, having high specific strength and stiffness have made agricultural waste ideal for use as construction materials. Coconut shell, oil palm shell, oil palm clinker, corncob ash, and rice husk ash are all agricultural by products. The waste materials are still disposed off into landfills or burnt, this leads to serious environmental problems. Coconut shell is one of the solid disposal wastes from agricultural activities. The use of coconut shells as one of the composite materials in the production of concrete was driven by the problem caused by the disposal of solid waste.

Coconut shell is one of the solid disposal wastes from agricultural activities. The use of coconut shells as one of the composite materials in the production of concrete was driven by the problem caused by the disposal of solid waste. Coconut shells represent more than 60% of domestic waste volume.

In addition the use of coconut shells in concrete production will give more benefits compared to conventional materials. If coconut shells are used for structural applications, it would not only be advantageous towards the environment, but also towards low income families, especially in the surrounding areas of coconut plantations.



Fig.1 Coconut Shell

2. Methodology

The following flowchart explains the methodology adopted in this research.

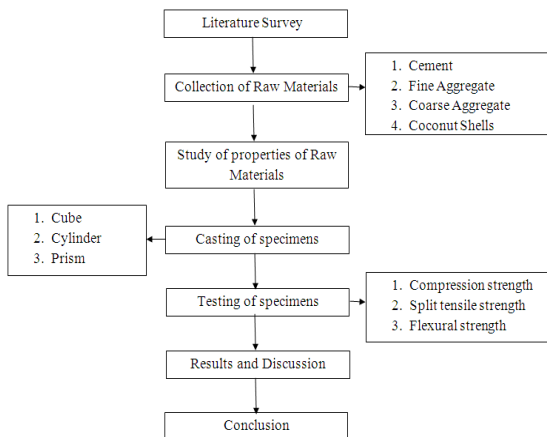


Fig. 2 Methodology flow chart

3. Materials and Methods

3.1 Cement

Ordinary Portland cement (OPC) of 53-Grade was used entire project. Tests for cement were carried out according to standards and the results are presented in table.

Table. 1 Properties of Cement

Sl. No	Characteristics	Result
01	Specific gravity	3.15
02	Fineness	2.44

3.2 Aggregate

Fine Aggregate

Aggregate is the granular material used to produce concrete or mortar and when the particles of the granular material are so fine that they pass through a 4.75mm sieve.

Table. 2 Properties of Fine Aggregate

Sl. No	Characteristics	Result
01	Specific gravity	2.65
02	Fineness	2.6

Coarse Aggregate

Coarse aggregates are a construction component made of rock quarried from ground deposits. Coarse aggregate are generally categorized as rock larger than a standard no.

Coconut Shell

Waste coconut shells were collected from premises of various temples. The coconut shells were broken by hammer into smaller size. The surface texture of the shell was fairly smooth on concave and rough on convex faces, sieve analysis of coconut shell.

Table. 3 Properties of Coarse Aggregate and Coconut Shell

Sl. No	Characteristics	Result	
		CA	CS
01	Specific gravity	2.74	2.6
02	Impact strength	15%	20%

4. Results and Discussion

Water Absorption Test Results (CUBES)

Table. 4 Water absorption test results for cubes

Coconut Shell (%)	7 th Day		14 th Day		21 st Day	
	Before curing	After curing	Before curing	After curing	Before curing	After curing
0%	8.138	8.458	8.578	8.780	8.820	8.900
10%	8.630	8.890	8.887	9.005	9.155	9.250
20%	8.867	9.070	8.981	9.245	9.350	9.515
30%	8.598	8.775	8.328	8.640	8.750	8.925

Water Absorption Test Results (CYLINDERS)

Table. 5 Water absorption test results for cylinders

Coconut Shell (%)	7 th Day		14 th Day		21 st Day	
	Before curing	After curing	Before curing	After curing	Before curing	After curing
0%	13.007	13.460	13.978	14.280	14.320	14.554
10%	13.188	13.885	14.081	14.545	14.562	14.638
20%	13.479	13.920	14.259	14.790	14.880	14.994
30%	13.089	13.880	14.000	14.338	14.430	14.618

COMPRESSION TEST RESULTS CUBES

Table. 6 Compressive strength test results for cubes

Sl. No	Coconut shell (%)	7 th day curing (N/mm ²)	14 th day curing (N/mm ²)	21 st day curing (N/mm ²)
01	0%	21.1	26.6	29
02	10%	23.3	33.5	35.25
03	20%	26.8	35.5	37.80
04	30%	22.6	32.6	34.26

Split Tensile Test Results Cylinders

Table. 7 Split tensile strength results for cylinders

Sl. No	Coconut shell (%)	7 th day curing (N/mm ²)	14 th day curing (N/mm ²)	21 st day curing (N/mm ²)
01	0%	3.8	4.3	4.62
02	10%	4	4.7	4.91
03	20%	4.3	5.1	5.32
04	30%	2.3	4.6	4.85

Conclusions

The study of the properties of coconut shell aggregate concrete has been carried out through experimental investigation. The experimental results indicate that coconut shell has good potential as coarse aggregate in lightweight concrete. In this chapter explains the conclusion of the project.

- 1) From the experimental results of shell has potential as lightweight aggregate in concrete. Also using the coconut shell as aggregate in concrete can reduce the material cost in construction because of the low cost and its availability is abundance.
- 2) It is conducted that the coconut shell are more suitable as low strength giving lightweight aggregate when used to replace common coarse aggregate in concrete production.
- 3) Experimental results of the project on coconut shell confirm that the coconut shell has potential as lightweight aggregate in concrete. Also, using the coconut shell as aggregate in concrete can reduce the material in coarse aggregate.
- 4) In our project the results obtained at max strength of 20% partially replacement of coconut shell as coarse aggregate.

References

- Afolayan, J.O., Ejeh, S.P., Amartey, Y.D. and Idris, A. "Use of coconut shell as coarse aggregate in lightweight concrete", *International Journal of current Research*, vol. 9, Issue, 08, pp.55499-55506, August, 2017.
- Ajay Tharwani, Ashish Sablani, Gaurav batra, Sakshi Tiwari, Divya Reel, Manish N.Gandhi, "Study of strength of concrete by using coconut shell" *International Journal of Innovative Science, Engineering & Technology (IJSET)*, Vol. 4 Issue 5, May 2017, ISSN (online) 2348-7968 | Impact Factor (2016).
- Ajim S.Shaikh, Sagar B.Thorat, Rahul V.Unde, Prasad S.Shirse, "Advance concrete-Aggregate replaced by coconut shell" *International Research Journal of Engineering and Technology (IRJET)*.
- Apeksha Kanojia, S.K.Jain, "Performance of coconut shell as coarse aggregate in concrete: A Review, *International Research Journal of Engineering and Technology (IRJET)*, volume:02 Issue:04 | july-2015.
- Kalyanapu Venkateswara Rao, A.H.L. Swaroop, Dr.P. Kodanda Rama Rao, Ch. Naga Bharath, "Study on strength properties of coconut shell concrete" *International Journal of Civil Engineering & Technology (IJCIET)*.
- Sanjay Kumar Verma and Sagar Shrivastava, "Use of coconut shell as partly substitution of coarse aggregate-An Experimental analysis", published online at 25 sep 2019.
- Shahiron Shahidan, Alif Syazani Leman, Mohamad Syamir Senin, Nurul izzati Raihan Ramzi Hannan "Suitability of coconut shell concrete for precast cool wall panek-A Reviw", *MATEC Web of conferences* 87, 01005 (2017), ENCON 2016.